



Univerza v Mariboru

Fakulteta za naravoslovje  
in matematiko

### UČNI NAČRT PREDMETA / COURSE SYLLABUS

<b>Predmet:</b>	<b>Metode znanstvenoraziskovalnega dela v biologiji</b>
<b>Course title:</b>	Methods of Scientific Research in Biology

Študijski program in stopnja Study programme and cycle	Študijska smer Study option	Letnik Academic year	Semester Semester
Biologija in ekologija z naravovarstvom, 2. stopnja	/	1	1
Biology and Ecology with Nature Conservation, 2 <sup>nd</sup> cycle	/	1	1

**Vrsta predmeta / Course type**

**Univerzitetna koda predmeta / University course code:**

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Lab. vaje Laboratory work	Druge oblike študija	Samost. delo Individ. work	ECTS
60	60		30		210	12

**Nosilec predmeta / Lecturer:**

**Jeziki / Predavanja / Lectures:**   
**Languages: Vaje / Tutorial:**

**Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:**

Jih ni.

**Prerequisites:**

None.

**Vsebina:**

**Content (Syllabus outline):**

- Metode znanstveno-raziskovalnega dela v biologiji in ekologiji so vsebinsko ciljno zasnovane glede na predvideno usmeritev posamezne/ga študenta/ke in obsegajo predstavitev temeljnih raziskovalnih metod v biologiji in ekologiji, ter pregled podrobne metodologije, ki jo bo študent/ka uporabil/a pri svojem raziskovalnem delu.
- Statistika. Osnovni pojmi teorije verjetnosti. Univariatne statistične metode. Osnove pojmi multivariatnih statističnih metod (analiza variance, analiza kovariance, regresijska analiza, faktorska analiza). Aplikacija v biologiji.
- "Izbrane tehnike izolacije in identifikacije naravnih substanc" obsegajo predstavitev aparaturne, pripomočkov in kemikalij za izolacijo proteinov z gelsko in ionsko izmenjevalno kromatografijo ter njihovo analizo s pomočjo fotospektrometrije in elektroforeze.
- Izolacija in identifikacija lipidov in živalskih pigmentov s tankoplastno kromatografijo in s kemijsko in fluorescenčno detekcijo.
- Izbrane metode v morfometriji in statistična analiza enorazsežnih spremenljivk.
- Geometrijske morfometrične metode in statistična analiza dvorazsežnih spremenljivk.
- "Izbrane metode v nevrofiziologiji" ter "Bioakustične meritve in analiza" so tematsko prirejeni pregledi metod in tehnik.
- Metode vzorčenja in numerične analize biodiverzitete (favne, flore in vegetacije).
- Morfološke metode na nivoju osebkov obsegajo standardno zajemanje in obdelavo biometrijskih podatkov različnih vegetativnih, reproduktivnih in drugih znakov osebkov.
- "Izbrane metode v ekologiji" so pregledna obravnava standardnih metod ekološkega vzorčevanja in obdelave podatkov s poudarkom na terestričnih habitatih.
- Predstavitev metod v fitocenologiji, njena tipološka obravnava na krajinskem nivoju in obdelava v GIS.
- "Izbrane metode iz biotehnologije rastlin" se osredotoča na tehniko rastlinskih tkivnih kultur in njeno uporabo v biotehnologiji.
- Predstavitev izbranih metod dela pri opazovanju vedenja živali.

- Methods of scientific research in biology are based upon the prospective individual student research. They are dealing with the selected themes on general research methods, and with an overview of the special methodologies in use by a student during his/her research work.
- Statistics. Basic concepts of probability theory. Univariate methods in statistics. Basic concepts of multivariate statistics methods (analysis of variance, analysis of covariance, regression analysis, factor analysis). Application in biology.
- The chapter "Selected techniques for isolation and identification of natural substances" includes the presentation of the equipment and chemicals used in protein gel plate and column chromatography, and the protein analysis using photospectrometry and electrophoresis.
- The use of thin layer chromatography with a chemical and fluorescent detection is discussed in the context with the isolation and identification of lipids and animal pigments.
- Selected methods in morphometry, and statistical analysis of one-dimensional parameters.
- Geometrical morphometrical methods, and statistical analysis of two-dimensional parameters.
- "Selected methods in neurophysiology", and "Bioacoustic recordings and analysis" represent an overview of the topic methods and techniques.
- Methods of sampling and numerical analysis of biota (fauna, flora and vegetation) are discussed in the chapter of "Biodiversity".
- Morphological methods on the individual level comprehend standard capture and treatment of biometrical data concerning different vegetative, reproductive and other traits of the specimens.
- "Selected methods in ecology" is an overview of standard methods of ecological sampling and data treatment, with an emphasis on terrestrial habitats.
- The presentation of methods in phytocenology, its topological treatise on the landscape-level, and the elaboration in GIS.
- "Selected plant biotechnological techniques" are focused on plant tissue culture techniques and its use in biotechnology.
- Presentation of methods in animal behavior researches.

### Temeljni literatura in viri / Readings:

- Alberts, B., A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter, 2002: Molecular biology of the cell, 4th Edition, Garland Science, New York.
- Bilodeau, M., D. Brenner 1999: Theory of Multivariate Statistics, Springer Verlag.
- Boulton A. A., G. B. Baker, C. H. Vanderwolf, 1990: Neurophysiological Techniques, I. Basic Methods and Concepts. Humana Press, Totowa.
- Cutler, P., 2003: Protein purification protocols. Humana Press, New York.
- Glauert, A. M., 1988: Practical methods in electron microscopy. North-Holland Publishing Company, Amsterdam, New York, Oxford.
- Kates, M., 1986: Techniques of lipidology. Elsevier, Amsterdam.
- Krebs, C. J., 1999: Ecological methodology. Addison Wesley, Boston.
- Legendre, R. A. Legendre, 2005: Numerical Ecology. Elsevir. Amsterdam.
- McPearson, G. 2001: Applying and Interpreting Statistics, Springer Verlag.
- Sokal, R. R., F. J. Rohlf, 1995: Biometry: the principles and practice of statistics in biological research. W. H. Freeman and Com. San Francisco.
- Southwood, T. R. E. & P. A. Henderson, 2000: Ecological methods. Blackwell, Oxford.

#### **Cilji in kompetence:**

- formulirajo izvirno raziskovalno vprašanje;
- pridobijo raziskovalne podatke in jih kritično ovrednotijo;
- predstavijo eksperiment v pisnem poročilu ali v znanstvenem članku;
- izkazujejo veščine in sposobnosti, potrebne pri eksperimentalnem delu;
- uporabijo temeljne znanstvenoraziskovalne metode in tehnike pri svojem delu.

#### **Objectives and competences:**

- formulate the original research question;
- obtain research data and critically evaluate them;
- present an experiment in a written report or in a form of scientific article;
- demonstrate the skills and abilities necessary for experimental work;
- to use basic scientific methods and techniques in their work.

#### **Predvideni študijski rezultati:**

Po uspešno opravljeni učni enoti naj bi bili študenti zmožni:

poznati temeljnjeskupine znanstveno-raziskovalnih metod in tehnik v biologiji in ekologiji.

uporabiti ustrezne raziskovalne metode in tehnike pri reševanju konkretnih znanstvenih problemov na izbranem področju.

ustrezno vzorčiti oziroma zajemati podatke ter izpeljati konkretne raziskovalne metode in tehnike.

#### **Intended learning outcomes:**

After the course, students are able to:

Student gets knowledge about the basic groups of research methods and techniques in biology and ecology

Student qualifies for selecting appropriate research methods and techniques, respectively, concerning concrete scientific problems within the topic field of investigation.

Student qualifies to make an appropriate sampling or data capture, respectively, and for carrying out concrete investigation methods and techniques.

#### **Metode poučevanja in učenja:**

#### **Learning and teaching methods:**

Predavanja Seminar Laboratorijske vaje	Lectures Seminar Laboratory work
--	--

Delež (v %) /

**Načini ocenjevanja:**

Weight (in %)

**Assessment:**

Način (pisni izpit, ustno izpraševanje, naloge, projekt): Seminarska naloga Predstavitev seminarske naloge	<b>50</b> <b>50</b>	Type (examination, oral, coursework, project): Seminar essay Presentation of seminar essay
--	------------------------	--

**Reference nosilca / Lecturer's references:**

KLOKOČOVNIK, Vesna, DEVETAK, Dušan. Pit-builder vs non-pit-builder : advantage of trap building strategy in antlion larvae does not mean greater behaviour diversity. *Behaviour*, ISSN 0005-7959, 2014, vol. 151, issue 5, str. 653-668, ilustr.

<http://booksandjournals.brillonline.com/content/journals/10.1163/1568539x-00003156>, doi: [10.1163/1568539X-00003156](https://doi.org/10.1163/1568539X-00003156). [COBISS.SI-ID [20356872](https://www.cobiss.si/id/20356872)]

KLOKOČOVNIK, Vesna, HAUPTMAN, Gregor, DEVETAK, Dušan. Effect of substrate temperature on behavioural plasticity in antlion larvae. *Behaviour*, ISSN 0005-7959, 2016, vol. 153, issue 1, str. 31-48, doi: [10.1163/1568539X-00003322](https://doi.org/10.1163/1568539X-00003322). [COBISS.SI-ID [21695496](https://www.cobiss.si/id/21695496)]

KLOKOČOVNIK, Vesna, ŠORGO, Andrej, DEVETAK, Dušan. Hands-on experiments on predatory behaviour with antlion larvae. *Journal of Biological Education*, ISSN 0021-9266, 2016, vol. 50, no. 4, str. 384-394, ilustr., doi: [10.1080/00219266.2015.1117513](https://doi.org/10.1080/00219266.2015.1117513). [COBISS.SI-ID [21928200](https://www.cobiss.si/id/21928200)]

KLOKOČOVNIK, Vesna, PODLESNIK, Jan, DEVETAK, Dušan. Occurrence of the antlion tribe Acanthaclisini in the Balkan Peninsula : (Neuroptera, Myrmeleontidae). *Spixiana : Zeitschrift für Zoologie*, ISSN 0341-8391, 2016, bd. 39, h. 1, str. 99-104, ilustr. [COBISS.SI-ID [22594568](https://www.cobiss.si/id/22594568)]